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Ten year retrospective evaluation of the seasonal distribution of agent viruses in childhood respiratory tract infections

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Abstract

Aim: Infections caused by respiratory viruses sometimes occur as epidemias or pandemias and are an important public health problem in the whole world. These viral agents may lead to severe respiratory diseases especially in young children and in the elderly. The aim of this study was to determine the seasonal distribution of agent viruses in childhood respiratory infections in our region.

Material and Methods: In this study, nasopharyngeal swab sample was obtained from 1 326 patients who presented to Ege University, Medical Faculty Children's Hospital between 2002 and 2012 and who were thought to have respiratory tract infection. Influenza virus type A and B, respiratory syncytial virus, adenovirus and parainfluenza virus type 1-3 were investigated using shell-vial cell culture method and direct fluorescent antibody test and/or multiplex PCR test. Parainfluenza virus type 4, human metapneumovirus, rhinovirus, coronavirus, human bocavirus were investigated using multiplex PCR test. The seasonal distributions of the viruses were determined according to the results obtained from Ege University Medical Faculty, Department of Medical Microbiology Clinical Virology Laboratory. Approval was obtained from the ethics committee (Ege University Clinical Researches Ethics Committee, 12.02.2013, number: 13-1/46).

Results: The majority of the patients who presented were outpatients (n:888, 67%) and the remainder were hospitalized patients (33%, n:438). Respiratory viruses were found in 503 of the nasopharyngeal swab samples (38%). Parainfluenza and respiratory syncytial virus were found most frequently in december-february (58% and 59%, respectively, influenza viruses were found most frequently in november-december (72%) and adenoviruses were found most frequently in may-september (56%).

Conclusion: Although only supportive therapies are administered generally in viral infections, viral investigations are important in terms of determining the measures to be taken by determining the causes as well as in terms of establishing a general database. Another benefit of this study would be strengthening clinical approach to patients and decreasing unnecessary antibiotic use. (Türk Ped Arş 2014; 49: 42-6)

Key words: Child, seasonal distribution, respiratory tract viruses

Introduction

Viruses are infectious agents which most commonly lead to childhood respiratory tract infections. Bacteria are observed more rarely. These pathogens are contagious depending on some factors incuding age, season, immunity status of the host and especially localization in the lower or upper respiratory tract.

Respiratory tract viral infections occur as an important public health problem, since they are prevalent, can lead to epidemics in the population and frequently cause to morbidity and mortality. Most viruses are transmitted by droplets and primarily lead to infection in the respiratory tract epithelium. They may cause to various conditions ranging from simple upper respiratory tract infection to more severe disease pictures including bronchiolitis, pneumonia, chronic lung disease and also to a picture of respiratory failure especially in the childhood by leading to triggerring of acute asthma attack. Among these agents, influenza, parainfluenza virus (PIV) and respiratory syncytial virus (RSV) generally lead to epidemics, while adenovirus, coronavirus and rhinovirus cause to endemic infections. With definition of new generation respiratory viruses (human metapneumovirus (hMPV), coronavirus, bocavirus etc.) which

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lead to a picture of acute respiratory failure in recent years many studies related with viral infectious agents and their epidemiological properties are being conducted (1).

The aim of this study was to determine seasonal distribution of the agent viruses in childhood respiratory infections in our region.

Material and Methods

The test results of 1326 children aged between 0 and 18 years who presented to Ege University, Medical Faculty Children's Hospital between 2202 and 2012 and from whom nasopharyngeal swab samples were taken considering viral respiratory tract infection were evaluated retrospectively. The results of Ege University, Medical Faculty, Department of Medical Microbiology Clinical Virology laboratory were screened. In the last 10 years, influenza A and B, RSV, adenovirus and PIV type 1-3 viruses were investigated in 1178 samples between 2002 and 2009 using *Shell vial* cell culture and direct fluorescent antibody test (DFA) and the same viruses were investigated in 88 samples between 2005 and 2009 using multiplex PCR test additionally. Between 2010 and 2012, influenza A and B, RSV, adenovirus and PIV type 1-3 were investigated in 148 samples using *Shell vial* cell culture and PIV type 4, hMPV, rhinovirus, coronavirus and bocavirus were investigated using multiplex PCR test. Approval was obtained from the ethics committee (Ege University Clinical Researches Ethics Committee, 12.02.2013, number:13-1/46).

Results

1326 pediatric patients with respiratory tract infection who presented to Ege University Children's Hospital between January 2002 and January 2012 were included in the study. The mean age of the study group was 26.2±16.1 months (1-144 months). The majortiy of the patients were outpatients (67%, n:888) and the remainder were hospitalized patients (33%, n:438).

The children presented with findings of respiratory tract infection or with a complaint of high fever during an epidemic. The main examination findings of the subjects were compatible with bronchiolitis, penumonia, bronchospasm or wheezing, bronchitis and laryngitis. Following examination and investigations the definite diagnoses included upper respiratory tract infection with a rate of 42%, pneumonia with a rate of 32% and bronchiolitis with a rate of 22%. Two patients presented to the hospital only with a complaint of high fever. Three patients presented with fever and diarrhea and two patients who were known to have prior idiopathic thrombocytopenic purpura presented with an association of high fever and thrombocytopenia. One patient was diagnosed with myositis with presence of high fever, leg pain, increased creatinine kinase level during an epidemic.

When the test results of Ege University, Medical Faculty, Department of Medical Microbiology, Clinical Virology Laboratory were screened, it was observed that respiratory tract viruses were positive in a total of 503 (38%) samples in 1326 pediatric patients who had findings of respiratory tract disease. The distribution of the viruses for which sample study could be performed between 2002 and 1009 was as follows: influenza A 36% (n:130), influenza B 1% (n:4), PIV 37% (n:131) (PIV type 1:10, type 2:3, type 3:118), RSV 15% (n:52), adenovirus 11% (n:38) (Figure 1). In the following years, PIV type 4, hMPV, rhinovirus, coronavirus and bocaviruses could also be investigated using multiplex PCR. The distribution of agent viruses between 2010 and 2012 was as follows: influenza A 20%, influenza B 4%, PIV 14% (PIV type 1: 6%, type 2: 1%, type 3: 4%, type 4: 3%), RSV 3% 2, adenovirus 8%, hMPV 3%, rhinovirus 13%, coronavirus 5% and bocavirus 1% (Figure 2).

Parainfluenza viruses and RSV were observed most commonly between December and February (58% and 59%, respectively). Influenza viruses generally were observed in November and December (72%) and Adenoviruses were observed most commonly between May and September (56%). The distributions of the viruses by years and seasons is given in Figure 3 and 4.

While respiratory syncytial virus, PIV tyep 3 and influenza viruses are shown as agents most commonly in the first two years of life, it was found that adenoviruses were generally the agents between the ages of 2 and 5 years.

Discussion

In respiratory tract infections, viruses are important in the whole world and in all age groups. They constitute a special threat in

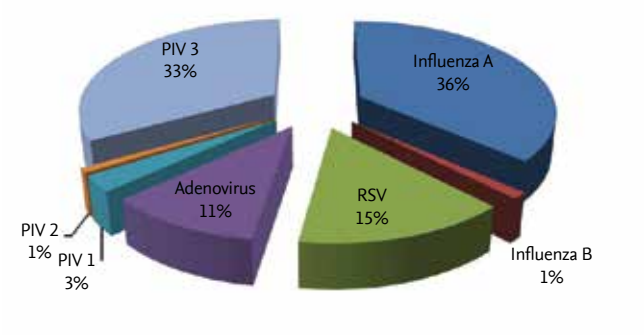

Figure 1. Distribution of the agent viruses in childhood respiratory tract infections between 2002 and 2009

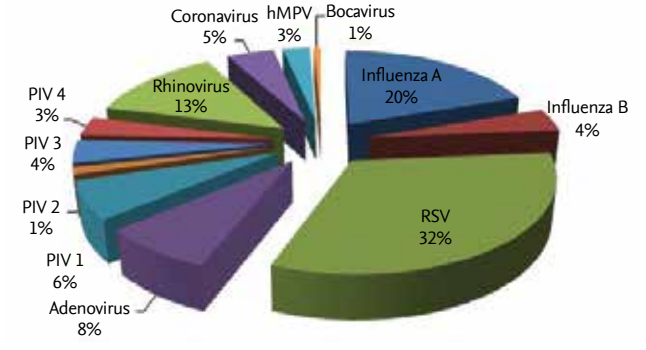

Figure 2. Distribution of the agent viruses in childhood respiratory infections between 2010 and 2012

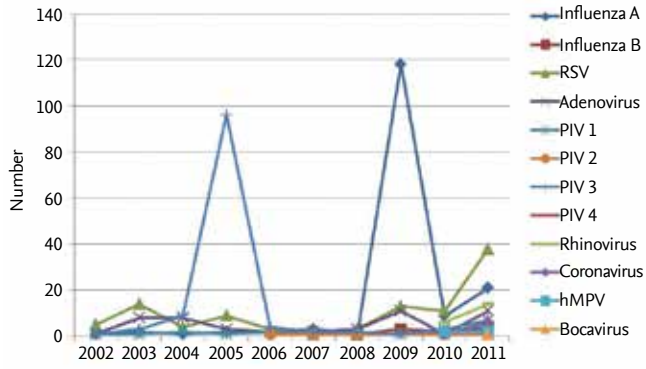

Figure 3. Distribution of the agent viruses in childhood respiratory tract infections by years

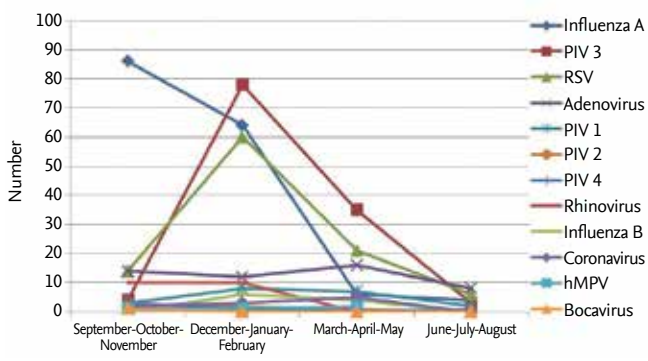

Figure 4. Distribution of the agent viruses in childhood infections by seasons

terms of public health because they lead to epidemics and pandemics (2, 3). The infections the cause may require long-term hospitalizaitons in young age groups and especially in infancy (4). In the whole world, definition of the viruses which show seasonal characteristics is important in terms of vaccine studies and vaccination processes (5-7).

Respiratory tract infections lead to significant morbidity and mortality especially in pediatric populations. Although the clinical findings of a respiratory tract disease can be defined easily, the agent can usually not be determined easily. In a study which investigated community-acquired pneumonias, it was reported that the agent could be defined in only 46% of the subjects by examination of sputum, serology and lower airway secretion and pleural fluids (8). It is thought that the majority of lower respiratory tract infections are viral infections (9-12). In our study, the agent could be demonstrated in 38% of the subjects. It is known that the most important agents of bronchiolitis and lower respiratory infections in children are RSV, parainfluenza and influenza viruses. However, the agent can not be defined in almost 1/3 of these infections (13-15).

The microbiological agents in respiratory tract infections may show variance depending on the characteristics including the underlying disease, age group, season and upper-lower airway involvement. However, it is known that RSV, influenza, PIV type 3 and adenovirus among viruses, s.pneumoniae, h.influenzae, n.meningitidis among bacteriae and fungi (aspergillus, candida especially in immunosupressed patients) may be the agents in all age groups (1). Viruses may require hospitalization and even intensive care therapy by leading to respiratory failure especially in the childhood age group. While influenza, parainfluenza, hMPV and RSVlead to epidemic infections, adenovirus, coronavirus and rhinoviruses mostly lead to endemic infections. Varicella, herpes viruses and cytomegalovirus lead to lower respiratory tract infection mostly in immunosupressed patients (16, 17).

Respiratory tract viral infections frequently show a seasonal distribution. The cause to epidemics which may show variance from year to year especially in temperate climate conditions. Both respiratory syncytial virus and influenza lead to infection in winter months (16, 18). In our study, RSV was found most commonly between December and February (59%). Influenza was frequently observed in November and December (72%). However, different prevalence rates may be reported in different regions; for example, it has been reported that RSV infection makes a peak in April-June in a tropical city (19). Epidemiological studies have shown that RSV infection may the most important single cause of severe lower respiratory tract infections including bronchiolitis and pneumonia in infancy and childhood. In addition, it may lead to severe pneumonia and mortality in patients with immunosupression (16). In our country, Biçer et al. (20) demonstrated viral agents in nasopharyngeal fluids by multiplex PCR in 66,5% of the children hospitalized because of lower respiratory infection and RSV was the most common agent with a rate of 32%. This was followed with adenovirus with a rate of 26.2%, PIV with a rate of 19.4%, rhinovirus with a rate of 18.4%, influenza A/B with a rate of 12.6% and hMPV with a rate of 12.6%. Coronavirus (2.9%) and bocavirus (0.9%) were found with low rates.

In our study, it was found that RSV was the most common agent following parainfluenza and influenza viuses and caused to infection most commonly in winter months as reported in previous studies. The reason that RSV was found to be the third most common agent was that the rate of RSV decreased because of the PIV type 3 (21) epidemic which occured in 2005 and the influenza A epidemic which occured in 2009 in our region. The fact that RSV was the most common agent in years when such epidemics did not occur is shows in Figure 3 clearly.

While parainfluenza virus type 3 is frequently the agent in winter months, type 1 and type 2 lead to infection mostly in fall and early winter months (16, 21). In studies performed in countries with a temperate climate, it has been reported to make a peak in fall-winter months (22). In our study, the majority of parainfluenza viruses (94%) were type 3 and type 1 viruses and they were observed to lead infection mostly between December and February when winter climate was experienced most intensively.

These viruses are mostly the agents of childhood diseases. In addition to being the most common cause of common cold and croup, they have been reported to be the second most common reason of presentation to hospitals because of respiratory diseases following RSV infection (2).

Adenovirus type 1, 2, 3, 5 and 7 are important agents of upper and lower respiratory tract infections. Since adenovirus is a considerably balanced virus, it is transmitted easily and lead to sporadic or epidemic infections (16). Although adenoviruses have been reported to lead to infection throughout the year, it was observed that they caused to infection most commonly between May and September (56%) in our study.

Rhinoviruses have more than 100 subgroups. They are the most common agent of common cold which is known to be an insignificant upper airway disease (16). As observed in our study (Figure 4), they lead to infection most commonly between September and February.

Although coronaviruses have been reported to lead to sporadic infection in winter and spring months and to be the agent in 10-15% of upper respiratory tract infections including common cold-otitis media, coronavirus could be investigated in the samples in the last two years in our study and its frequency was found to be 5%. In the study of Biçer et al. (20), the frequency of coronavirus infection was found to be as low as 2.9%. Similarly, bocavirus was also demostrated with considerable low rates (1%). Human metapneumovirus is a new virus which is generally reported in respiratory tract infections in children with a rate of 6% (2). In our study, it could be demonstrated with a low rate like coronaviruses (3%). It is considerably lower compared to the rate of 12.6% reported in the study of Biçer et al. (20). Since the signs and symptoms in viral respiratory tract diseases are not specific, laboratory is necessary to determine the etiological agent. The main priority in terms of respiratory tract viruses is development of efficient therapeutical agents and preventive vaccines excluding influenza virus (16).

Conclusion

Although supportive therapies are administered primarily in viral infections, detection of the annual and seasonal distribution of agent viruses by swab samples will provide precautions to be taken against these diseases in the early period and establishment of a common database related with this subject. Detection of respiratory viruses which are known to cause seasonal and annual epidemics will facilitate the approach to patients with similar pictures observed frequently in the community and prevent unnecessary antibiotic use.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Ege University Clinical Researches Ethics Committee.

Informed Consent: Because this study was conducted as a retrospective study, informed consent was not taken.

Peer-review: Externally peer-reviewed.

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